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AIR FORCE ENGINEERING AND SERVICES CENTER TYNDALL AFB FL F/G 1/2  
AN EVALUATION OF THE BIRD/AIRCRAFT STRIKE HAZARD AT HILL AFB, U--ETC(U)  
JAN 79 J J SHORT, J S KENT, A L BUDDIN  
AFESC-TM-1-79

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# AN EVALUATION OF THE BIRD/AIRCRAFT STRIKE HAZARD AT HILL AFB, UT (AFLC)

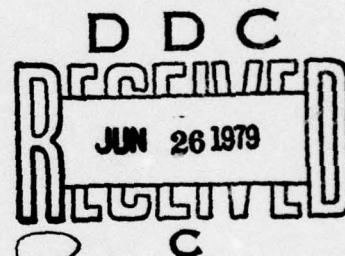
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JANUARY, 1979



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## PREFACE

This study was performed under Program Element 91212F, AFESC JON 00DEVN11. Inclusive dates of the survey were 30 Sep to 12 Oct 1978 and from 28 to 30 Jan 79.

For your quick reference and use a concise summary of observations and recommendations follows the Table of Contents.

This memorandum has been reviewed by the Information Office (OI) and is releasable to the National Technical Information Service (NTIS). At NTIS it will be available to the general public, including foreign nations.

This memorandum has been reviewed and is approved for publication.

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## SUMMARY OF OBSERVATIONS AND RECOMMENDATIONS

1. Observations: A bird/aircraft strike hazard exists at Hill AFB. The following factors have a direct relationship to this hazard:

a. A program to reduce bird strike hazards does not presently exist. This program is a requirement of AFR 127-15.

b. Operational considerations can help reduce bird hazards by flying at times and in formations which are conducive to bird strike avoidance.

c. A system for bird density and hazard determination in the airdrome is needed to inform pilots of bird hazards in the local area.

d. Information concerning current bird densities and areas of greatest hazards in the region would help in planning low level sorties to minimize bird strike threats.

e. In the airdrome, gulls present the greatest bird strike threat.

f. Grasshoppers on the airfield are presently killed with an annual spraying of Malathion. The current single spraying each year may not be enough to reduce the gull attractant.

g. Standing water in the drainage retention pond on the southwest portion of the airfield is attractive to birds. The surface area of the pond is presently being enlarged as earth is taken from the pond and used as fill.

h. Pest birds including pigeons, starlings, and house sparrows present a bird strike threat as they cross the airfield. They also leave unsightly, corrosive droppings in and around hangars and storage buildings.

## 2. RECOMMENDATIONS:

a. A Bird Hazard Working Group should be formed to prepare a plan for reduction of bird strike potentials. The group, composed of representatives of Civil Engineering, Flying Safety, Flight Facilities, and Airfield Management, could meet as part of the base's Air Traffic Control Board.

b. The Bird Hazard Working Group should establish flying procedures which reduce the risk of bird strikes.

Examples may be reducing wing takeoffs, requiring full stop landings and holding aircraft departures when serious bird hazards exist.

c. Control tower personnel should be constantly alert for bird activity near the airfield. An incremental BIRD WATCH system similar to a MET WATCH for weather would keep pilots aware of immediate bird hazards.

d. Maps similar to the one in the Safety Office of the 4th Tactical Fighter Squadron should be available to all flying organizations and in Base Operations. The base biologist should gather information on the local bird densities so pilots can be briefed on current conditions. Mishap Prevention Bulletins, Notices to Airmen (NOTAMS), entries in the IFR Supplement for Transient Aircrews, and safety briefings provide excellent opportunities to warn of bird hazards in the local area.

e. Gull reduction on the airfield can be enhanced by maintaining grass heights at 20 to 30 centimeters (8 to 12 inches), continuing airfield insect control, and using bioacoustics, pyrotechnics and depredation.

f. The Pest Management Section should check the airfield twice each month from May through September to estimate grasshopper populations. If grasshoppers begin attracting gulls, additional insecticidal applications will be necessary. The services of a commercial pest controller may be required if the Pest Management Section does not have the capability for an extensive spraying operation.

g. The drainage retention pond should be deepened and channelized to reduce the surface area of the standing water. This would not reduce the storage capacity of the pond. If birds are still attracted to the pond, a wire grid should be placed over the water to discourage use by birds.

h. A pest bird reduction program using trapping, shooting and poisoning will provide comprehensive bird control in and around hangars and storage buildings.



## SECTION I

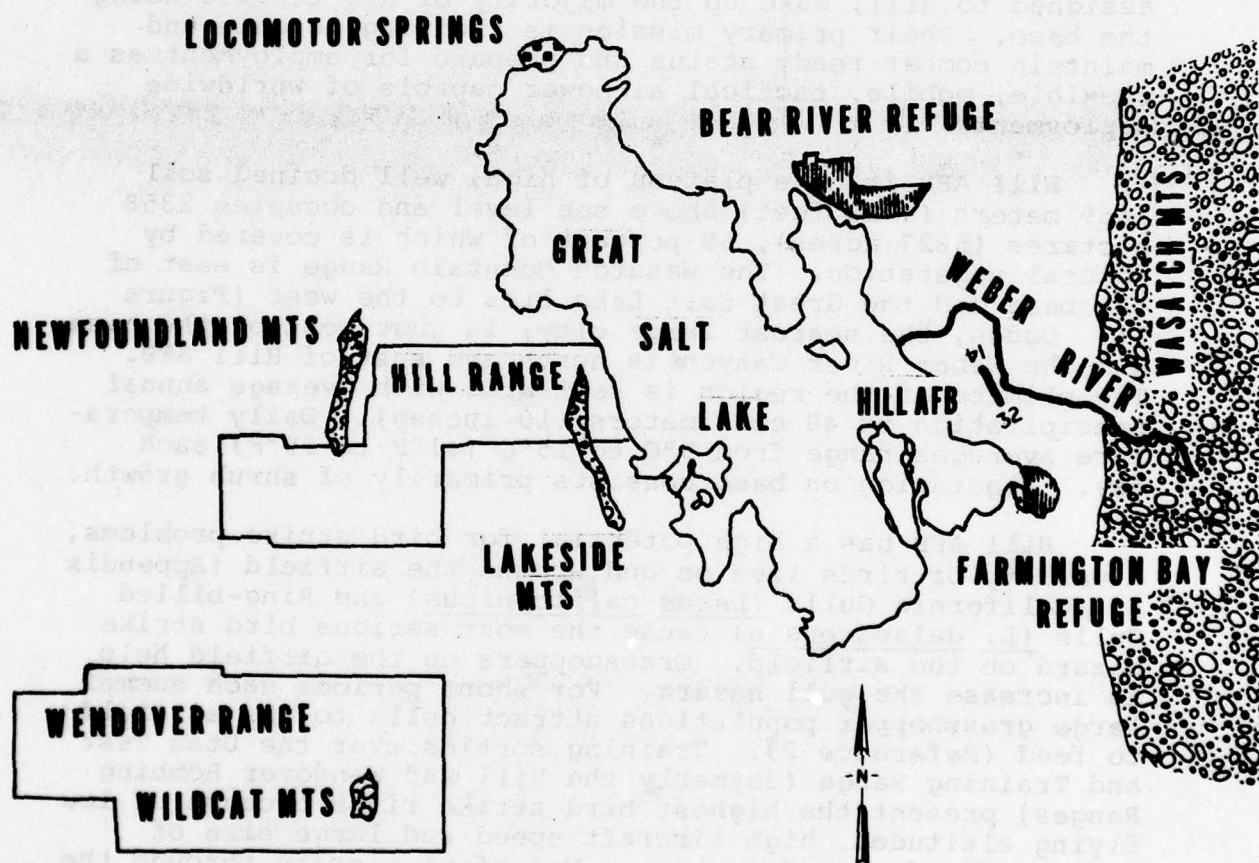
### INTRODUCTION

Hill Air Force Base is a Logistics Command installation located in north central Utah. The 2849th ABG, Ogden ALC, is the major organization at Hill AFB (Reference 1). Tenant units at Hill AFB include the 388th Tactical Fighter Wing and the 508th Tactical Fighter Group (Air Force Reserve). Fighter aircraft, the F-16, the F-4 and the F-105B, permanently assigned to Hill, make up the majority of air traffic using the base. Their primary mission is training to gain and maintain combat ready status and prepare for employment as a flexible, mobile, tactical airpower capable of worldwide deployment.

Hill AFB is on a plateau of high, well drained soil 1459 meters (4788 feet) above sea level and occupies 2358 hectares (5827 acres), 69 percent of which is covered by natural vegetation. The Wasatch Mountain Range is east of the base and the Great Salt Lake lies to the west (Figure 1). Ogden, the nearest large city, is just west of the base and the Weber River Canyon is north and east of Hill AFB. The climate of the region is semi-arid with average annual precipitation of 48 centimeters (19 inches). Daily temperature averages range from 5°C to 15°C (41°F to 59°F) each day. Vegetation on base consists primarily of shrub growth.

Hill AFB has a high potential for bird strike problems. A variety of birds live on and around the airfield (Appendix A). California Gulls (Larus californicus) and Ring-billed Gulls (L. delawarensis) cause the most serious bird strike hazard on the airfield. Grasshoppers on the airfield help to increase the gull hazard. For short periods each summer large grasshopper populations attract gulls to the airfield to feed (Reference 2). Training sorties over the Utah Test and Training Range (formerly the Hill and Wendover Bombing Ranges) present the highest bird strike risks because of low flying altitudes, high aircraft speed and large size of gulls, waterfowl and raptors. Waterfowl migrate through the region and several refuges in the area hold many birds for extended periods. Raptors (birds of prey) migrate through and live in mountain ranges used for training. Hill AFB was surveyed for bird hazards in 1973 (Appendix B). The purpose of this report is to evaluate the present situation and provide a more comprehensive bird hazard reduction program for the base, particularly concerning new aircraft operations. This report outlines a bird control and warning system for the base, discusses operational methods of reducing bird strike hazards, provides information sources for local bird

## NORTHWEST UTAH AND HILL AFB



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populations, and addresses pest bird control problems. No program will totally eliminate the possibility for bird strikes. As long as birds and aircraft share airspace, strikes will occur. The potential for these strikes can be reduced and flight safety enhanced through a program operated by qualified, motivated personnel.

#### 1. Bird Hazard Working Group

Will AFB does not have an organized program to reduce bird strike hazards. This program is required by AFR 11-12.

#### RECOMMENDATION:

A Bird Hazard Working Group (BWG) should be formed with members from Wing Safety, Director of Operations, Wildlife Facilities, Base Operations and Civil Engineering. The Group should review all aspects of the bird hazard problem and determine a course of action for a BWG program. In addition to implementing recommendations in this report, the Group should review the local flying operations and determine what modifications could be made to reduce bird hazards and make pilots aware of the hazards. The BWG should:

- a. Define the local bird problem and possible changes in procedures to avoid the birds.
- b. Develop a plan to carry out avoidance procedures.
- c. Define responsibilities for various aspects of bird control.
- d. Inform Aircrew of procedural changes to be initiated.
- e. Prepare briefings, posters, etc., for educating Aircrew on bird strike hazards.
- f. Review and modify procedures and recommendations to improve the base's BWG program.

The BWG need not be a separate group, interesting workshops with meetings and reports. Ideally, the BWG should be a subcommittee of an existing group such as the Air Traffic Control Board, Safety Council or some similar group. The BWG program can be created as an open agenda item, resolving problems concerning implementation of these



## SECTION II

### OBSERVATIONS AND RECOMMENDATIONS

Recommendations for each observation in this report are listed in order of priority. If lack of manpower or funds postpones implementation of some recommendations, subsequent recommendations should be accomplished, responding to delayed recommendations when resources become available.

#### 1. Bird Hazard Working Group.

Hill AFB does not have an organized program to reduce bird strike hazards. This program is required by AFR 127-15.

#### RECOMMENDATION:

A Bird Hazard Working Group (BHWG) should be formed with members from Flying Safety, Director of Operations, Flight Facilities, Base Operations and Civil Engineering. The Group should review all aspects of the bird hazard problem and determine a course of action for a BASH program. In addition to implementing recommendations in this report, the Group should review the local flying operation and determine what modifications could be made to reduce bird hazards and make pilots more aware of the hazards. The BHWG should:

- a. Define the local bird problem and possible changes in procedures to avoid the birds.
- b. Develop a plan to carry out avoidance procedures.
- c. Define responsibilities for various aspects of bird control.
- d. Inform aircrews of procedural changes to be initiated.
- e. Prepare briefings, posters, etc., for educating aircrews on bird strike hazards.
- f. Review and modify procedures and recommendations to improve the base's BASH program.

The BHWG need not be a separate group, increasing workloads with meetings and reports. Ideally, the BHWG should be a subcommittee of an existing group such as the Air Traffic Control Board, Safety Council or some similar group. The BASH problem can be treated as an open agenda item, resolving problems concerning implementation of these

recommendations, in addition to developing and overseeing the BASH program for the base.

## 2. Operational Considerations.

When environmental modification and active controls do not satisfactorily reduce bird hazards on the airfield, options must be considered for modifying the flying operations to reduce the risk of bird strikes. These operational changes will be dictated by the severity of the problem, the performance capability of the aircraft, and training or readiness requirements. Bird/aircraft strike hazards are like any other safety hazard which must be assessed with respect to operational requirements. During contingency operations or advanced stages of readiness, bird hazards are obscured by usual safety priorities. However, during training to maintain operational readiness, certain changes can be made to improve safety and reduce costly repairs. Responsibility and authority for bird hazard reduction should be dictated by the BHWG.

### RECOMMENDATIONS:

a. The Runway Supervisory Unit (RSU) controller can play a major role in operational bird avoidance and bird control. Because the RSU is located near the touchdown zone, the RSU controller has a better view of the bird hazards than Tower personnel and can warn the aircrews of the hazard. RSUs are equipped with radios and telephones, providing all the necessary tools to warn pilots, initiate a BIRD WATCH, and direct a bird patrol to an area where the birds are concentrated. Working with Tower, Approach Control and the SOF, he can make immediate changes in operational procedures to improve safety. He can change formation departures and landings, coordinate restrictions in low approach altitudes, request pilots to enter holding patterns, require pilots to make full stop landings and coordinate aircraft recoveries at intervals when bird activity is diminished. As a safety observer, his duties in bird hazard reduction complement other functions of evaluating landings and performing safety checks of aircraft. The RSU controller should be given authority to cancel landing or takeoff clearances as necessary to avoid an apparent conflict between birds and aircraft. He should also be given the authority as a safety observer to declare or change BIRD WATCH (discussed later in this report) conditions as the situation dictates.

b. Takeoffs or planned touch-and-go operations should be aborted if a bird strike occurs and sufficient runway remains to stop. Bird strikes can cause undetectable damage which may result in a complex airborne emergency. Damage



assessments can only be made by maintenance personnel. Several bird strikes which appeared to cause only minor damage have proven to be much more substantial and, had the pilot continued the mission, a serious emergency would have resulted. Structural damage, such as a dent in the wing, has led to fuel and hydraulic system failures.

c. Aircraft making formation departures increase their risk of damaging bird strikes when birds are feeding or loafing on and near the runway. This situation can be avoided by making single-ship departures and by using active controls to scare off the birds before formation departures. Wing and interval takeoffs with the wingman taking a 6- to 10-second spacing often result in birds being scared up by the lead aircraft. The wingman then hits the birds. Birds may be scared up by departing aircraft requiring pilots of lead aircraft to be alert and warn wingmen of bird hazards during takeoff roll. Wingmen may elect to abort or delay the formation takeoff if flocks of birds are scared up by lead aircraft. This is especially important for wing takeoffs when all of the wingman's concentration is on what the leader is doing, and he is thus unaware of the size of the bird hit or its impact location. Flight leaders should also warn other members of the flight when aircraft take spacing on the runway by delaying brake release.

d. Where flocks of migratory birds are a problem, aircraft formation departures involving rejoins increase the risk of serious bird strikes. Turning and straight-ahead rejoins require greater attention by pilots to the lead aircraft's position. Pilots cannot adequately clear for birds while simultaneously attempting to join on lead's wing. The increased speed necessary to overtake the lead aircraft after takeoff further increases the risk of damaging bird strikes. When birds are known to be flying in the area, departures under visual meteorological conditions (VMC) may require modification to reduce the risks. Departures should be made in trail, with the rejoin beginning after the aircraft pass 3000 feet AGL. If aircraft are to immediately enter a low level route or stay at an intermediate altitude for a prolonged period of time, a tactical formation would be advised, which would provide sufficient aircraft clearance to allow wingmen to clear for birds. When weather is a factor, wing takeoffs are preferred, realizing that many bird strikes occur just before entering a low overcast or immediately above an overcast sky condition.

e. Aircraft experiencing enroute bird strikes should abort the mission, and the aircraft should land as soon as possible. While an engine ingestion or a canopy strike may be readily apparent from the cockpit, many fuselage, wing,



tail or radome strikes cannot be adequately assessed for damage. Continuance may result in greater structural damage and an emergency situation later in the flight.

f. Post low-level bird strikes with fighter aircraft have resulted in the loss of 8 lives and 11 aircraft. Higher aircraft speed and greater exposure within the bird's flight environment have also led to many damaging and injurious bird strikes. Many of these strikes occur at low level and bombing range entry points where pilots and weapons systems operators are involved in cockpit duties which cause crewmembers to reduce their eye contact outside of the cockpit. Greater emphasis needs to be placed on "heads-up" flying during these critical transitions. Checklist items should be accomplished in such a manner as to allow for maximum eye contact outside of the cockpit.

In reviewing F-111 accidents where bird strikes have destroyed the aircraft and the crew has survived, certain factors are clear: wind blast, rapid deterioration of engine performance, failure of cockpit communications, or personal injury have all resulted in disorientation and chaos. Briefing of bird strike emergency procedures before each flight may save an airplane and its crew. An inflight bird strike is much like a takeoff emergency where urgency dictates a pre-planned course of action. As a minimum, pilots should brief (or be briefed) on the following:

- (1) Wear of the double helmet visor during daylight hours, the clear visor at night.
- (2) Lost cockpit communications.
- (3) Positive change in aircraft control.
- (4) Climbing flocks of birds are encountered because most flocks are distributed in a downward direction in the air space.
- (5) Evasive maneuvers at low altitude.
- (6) The needs and procedures for a controllability check in the event of a damaged airframe.
- (7) Engine failure procedures if birds are ingested.
- (8) Aircraft recovery procedures and routes of flight to return to base with a minimum of cockpit communication.
- (9) Locking of shoulder harnesses on injured crew-

members to prevent falling forward onto flight controls.

(10) Ejection procedures in the event that control cannot be maintained.

An aircrew's ability to react to a bird strike situation is further enhanced by briefing bird strike procedures during continuation training and safety meetings.

### 3. Airfield Bird Warning System.

A system to describe bird densities is needed to warn pilots of immediate hazards in the airdrome and permit operational changes to reduce the risk of bird strikes.

#### RECOMMENDATION:

BIRD WATCH: Specific operational procedures for improved bird avoidance should begin as soon as a threat has been identified by tower, approach control, or pilots flying in the local area. Just as MET WATCH informs pilots of severe weather, BIRD WATCH warns pilots of possible danger because of heavy bird concentrations in the area. The advanced warning helps the pilot to begin alternate procedures that are established by the flying unit and the BHWG. Full stop landings, restricted low approaches, diversions, and delays in departures exemplify operational changes designed to reduce bird strikes.

BIRD WATCH conditions should correspond to the degree of the hazard. This insures rapid relay of the hazard to the pilots and those agencies required to respond to correct the hazardous condition. The BIRD WATCH conditions are designated as follows:

(1) BIRD WATCH Condition Red - When heavy concentrations of birds are observed on or above the active runway, or flying in the pattern at flight altitude. These birds pose an immediate, severe threat to safe flying operations and only emergencies, minimum fuel aircraft, and transient aircraft appraised of the hazard are allowed to land. A local example is when large flocks of gulls are feeding or loafing on the airfield.

(2) BIRD WATCH Condition Yellow - Bird activity occurring on or around the runway could pose a threat to aircraft, if these birds are moving in a predictable manner or are isolated in a specific area on the airfield. Close monitoring of the bird activity is required until the heavy concentration has dispersed. The BIRD WATCH condition may be elevated to Condition Red if the birds become a direct threat to flying



operations. Pilots should be notified of the potential hazard of flying. Adjustments to the traffic pattern ground track may be used to avoid bird concentrations. Examples would be birds following grass cutters, bird flocks migrating over the airfield, etc.

(3) BIRD WATCH Condition Green - This condition is declared when the bird strike hazard is increased by migratory birds and specific hazard locations are identified. This condition warrants additional briefings on bird strike hazards prior to takeoff, especially for low-level sorties flown during the fall bird migratory season. These BIRD WATCH conditions should be declared by the Supervisor of Flying, following notification by tower personnel or pilots flying in the local areas.

#### 4. Bird Avoidance and Warning.

Low level routes cross areas of high waterfowl migration. Several wildlife refuges, including Bear Rivers Refuge and Locomotive Springs, are in the Great Salt Lake region (Figure 1). Waterfowl numbers are highest in April, May, September, October and November each year (Reference 3). U.S. Fish and Wildlife Service and Utah Wildlife Resources personnel maintain population censuses which are updated biweekly. Raptors also migrate through the area and live in mountain ranges used in training missions. They prefer windward sides of ridges when soaring and hunting. Information on population densities, feeding areas and nesting locations is useful for mission planning to minimize flying during peak bird activity. Captain David Elliot of the 4th Tactical Fighter Squadron has prepared an excellent map which depicts those areas in the vicinity where birds create severe hazards and shows where bird strikes have occurred. Murray Sant, the base biologist, has extensive experience working with State and Federal wildlife personnel and can effectively obtain and distribute information on population densities and locations of the various birds.

#### RECOMMENDATIONS:

a. The map made by Captain Elliot should be reproduced and distributed to all flying squadrons on base. The map should also be available to transient aircrews in Base Operations. This map should be updated as migratory bird populations change during the year.

b. The base biologist should act as a liaison between refuge managers and biologists in the local area and the Air Force. He can prepare and distribute information about local bird movements and population levels to flying organi-



zations on base. A program has been proposed to survey raptor populations over the Utah Test and Training Range with participation by the Air Force, the U.S. Fish and Wildlife Service and the Utah Department of Wildlife Resources (Reference 4). Information from this study would be valuable for determining areas to avoid along low level routes. The BASH Team supports the project. A paper from the Utah Cooperative Wildlife Research Unit entitled, "An Inventory of Major Animal and Plant Populations of Hill and Wendover Bombing Ranges, Western Utah," also provides excellent information on birds found in the area.

c. Dawn and dusk are times of greatest local daily bird activity, and migration often occurs at night. Minimized flying during these periods and avoiding flights over refuges and ridges reduces the chance of a bird strike.

Flight restrictions often prevent scheduling around peak bird activity. In such cases, Mishap Prevention Bulletins, pre-flight safety briefings, and safety reminders, such as keeping visors down, can reduce potential risks.

## 5. Gulls.

California Gulls and Ring-billed Gulls are abundant around the Great Salt Lake. Several large rookeries are in the area, and population levels have increased to the point that these birds cause problems on regional wildlife refuges (Reference 3). The Davis County Sanitary landfill, approximately 4 kilometers (2.5 miles) south of the airfield, attracts many gulls which fly over the airdrome. Grasshopper (order Orthoptera) populations reach their peak each year in late summer and attract large numbers of gulls to the airfield to feed. This problem has resulted in closure of the base to air traffic for several days in past years (Reference 2). Airfield grass is cut short, less than 10 centimeters (4 inches) (Reference 5).

### RECOMMENDATIONS:

a. Airfield grass should be kept long. Grass height management has been an effective tool for bird control in Europe (Reference 6). Maintaining grass heights of 20 to 30 centimeters (8 to 12 inches) effectively discourages gulls from using airfields to loaf and feed. The higher vegetation interrupts the birds' line of sight and reduces the security birds feel while on airfields. Longer grass also makes food more difficult for birds to find. Grass heights over 30 centimeters encourage increased rodent populations which will draw raptors to the base. Once each year the grass should be cut short (10 centimeters) to help reduce rodent

habitat and aid pesticide penetration. Spring is an excellent time for this short cutting because birds are mating and flocking behavior is reduced. During periods of heavy gull activity, base personnel may have to scare birds to allow safe flying operations to continue.

b. Active control may be necessary. Personnel responsible for scaring birds are designated by the BHWG. At most bases this activity has been the responsibility of Base Operations. Pyrotechnics and bioacoustics effectively scare birds from airfields and provide excellent short term control. Equipment for scaring birds has been stock numbered and is available for procurement through supply channels (Appendix C).

Bioacoustics is a technique of playing recorded distress calls emitted by a bird under stress. Distress calls are species specific; what works for California Gulls may not be effective for Ring-billed Gulls. A speaker should be mounted on a vehicle equipped with a cassette tape player and a mobile amplifier. The system should produce distortion-free sound at 90 to 110 decibels with a frequency response between 12,000 and 14,000Hz. In operation, personnel identify the species of bird and select the proper cassette tape. The vehicle is driven to within 90 to 140 meters (100 to 150 yards) of the birds. The distress call is played for 20 to 30 seconds and turned off. If the birds have not moved within 20 seconds, a second call should be played for the same duration. Do not allow the tape to keep running. Playing the tape continuously will cause the birds to eventually ignore the distress calls. With some species of birds, one or two minutes may be required to obtain the desired response to the distress calls. Frequently when the distress call is used, the birds rise up and fly towards the loudspeaker. They look for a short time at the "distressed bird" and then fly away. At other times birds may circle the vehicle, flying higher and higher, creating a hazard to flying aircraft. Pyrotechnics used at this time will hasten the departure of the birds. Distress calls of various birds are available on request from HQ AFESC/DEVN.

Pyrotechnics effectively reinforce bioacoustics. The recommended pyrotechnic is the M-74 airburst which is fired from an M-1 pyrotechnic pistol. When fired, a projectile travels about 90 meters and explodes with a sharp noise and flash of light. The operator should position himself between the runway and the birds, 90 to 140 meters from the flock and fire towards the birds. The airburst should detonate on the near side of the flock, driving them in the desired direction. The airburst should be fired at an angle high enough to prevent an explosion on the ground which may cause



grass fires. Two fire extinguishers are required when pyrotechnics are used. For safe use, constant coordination with tower personnel is necessary to prevent scaring birds into the path of arriving and departing aircraft. Under no circumstances discharge pyrotechnic close to aircraft or fuel. Fragments from the pyrotechnics should be removed to prevent foreign object damage (FOD) to aircraft. The operator must wear goggles, gloves and ear protectors.

Shellcrackers are other pyrotechnics which are fired from shotguns. They have recently been authorized on an emergency basis for use in bird control. The shotgun used must be 12 gauge, single barrel, break away, open bore and must be thoroughly cleaned after each day's use (Appendix D). The chief advantage of using shellcrackers is the reduced cost. Until permanent authorization is granted, we recommend the M-74 airburst be used when available. When using any pyrotechnic, rigid controls must be established for issue, safe use and storage to insure rapid access to meet immediate bird control needs. When transporting pyrotechnics from munitions storage facilities, four "Class B" explosives signs must be fixed to the vehicle used.

Regardless of the scaring methods, birds may become habituated to various techniques and reinforcement is necessary. Killing several birds with a shotgun and number 6 birdshot will convince the others the danger is real and make bio-acoustics and pyrotechnics more effective. Before killing any protected birds, a federal depredation permit must be obtained from the U.S Fish and Wildlife Service. The base biologist can assist with this procedure.

#### 6. Airfield Insect Control.

Grasshoppers on the airfield are a potential food source for gulls and other insectivorous birds at Hill AFB. They are currently being controlled by an annual application of Malathion insecticide by the base Pest Management Section (Reference 7). Grasshopper control was originally recommended by the 1973 BASH survey (Appendix B). At the request of Base Operations personnel, the insecticide is applied after the Pest Management Section determines that most of the nymphs have hatched in order to insure a maximum kill rate with the single annual application. The insect control program was initiated in 1975 with an aerial application of insecticide for grasshopper control. The aerial spraying resulted in problems with poisoning local honey bees, and ground spraying is the method used from 1976 until the present. This program has resulted in sufficient control of the grasshopper populations.



#### RECOMMENDATION:

(1) Continue the spraying program. In an effort to make grasshopper control more effective, the Pest Management Section should conduct population surveys of the airfield every two weeks with a sweep net from June to September and advise Base Operations when insecticide applications are to be made. This will more accurately determine grasshopper kill rates and help predict the need for future insecticide applications if a bumper crop of grasshoppers occurs in a given season. The Pest Management Section should be prepared to begin semi-annual insecticide applications if grass height management causes increased grasshopper populations on the airfield.

#### 7. Standing Water.

Standing water, particularly in an arid region, is an important bird attractant. A runoff retention pond exists near the departure end of Runway 14. During the survey, flocks of Rock Doves (Columba Livia) and American Avocets (Recurvirostra americana) were observed around the water. The water occupies a significant surface area and the pond is expanding as gravel is removed from the area for construction fill.

#### RECOMMENDATION:

The storage area for the water runoff should be deepened to reduce the surface area while retaining the same storage volume. Steep banks are less attractive to wading birds and give a better opportunity for pollutant separation if a fuel spill occurs. Construction fill should be obtained from other sources.

#### 8. Pest Birds.

Pigeons roost in many hangars and storage buildings at Hill AFB. Pigeon droppings create an unsightly, unsanitary working environment. Bird excrement is caustic to equipment and results in wasted manhours in cleanup. The Pest Management Section is responsible for pigeon control which is presently accomplished with Avitrol (Reference 8).

#### RECOMMENDATIONS:

a. The only permanent solution to pigeon problems is permanent exclusion of the birds from hangar superstructures. This can be accomplished by building a false ceiling with a plastic netting. The BASH Team is currently involved in a testing program to find a netting which meets acceptable Air

Force fire standards. Information concerning acceptable nettings will be published at a later date. This solution is expensive, and an extensive problem must exist to justify the expense.

b. Shoot the birds. A 12 gauge shotgun is authorized for bird control (Appendix C). Shooting pigeons provides short term bird control and must be continued to be effective.

c. Trap the birds. During the winter when food supplies are scarce, trapping can effectively remove many pigeons. This method permits the release of non-target species. A trap design is provided in this report (Appendix D). Birds should be pre-baited with cracked corn and water for several days before trapping. Roof tops of buildings where the pigeons roost are ideal trapping areas. Provide fresh bait and water each day. After the birds begin feeding heavily in the area, place the trap on the roof and bait it. Remove birds each morning and each afternoon. Clean up excess corn and provide fresh bait each day. Leave one or two healthy birds in the trap to act as decoys for other pigeons. When the pigeons have been removed from the trap, the base veterinarian can provide information for proper disposal. Continue trapping until the results no longer justify the effort. Trapping is effective only during food shortages, and pigeon numbers will increase over the rest of the year.

d. Continue poisoning the pigeons. Pigeons are not a protected species, and any humane measure for control may be considered. The poisoning program has been used to control pigeons in the winter. Avitrol has been the poison used.

#### REFERENCES

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6. Blokpoel, Hans, Bird Hazards to Aircraft, Clarke Irwin Co., Canada, 1976.
7. Goodrich, Phillip, Pest Management Shop Foreman, Hill AFB, Utah, Personal Communication, 1978.
8. Sant, Murray O., Biologist, Hill AFB, Utah, Personal Communication, 1979.



## APPENDIX A

### Birds\* Observed During the BASH Survey of HILL AFB and the Utah Test and Training Range

American Kestrel	<u>Falco sparverius</u>
Prairie Falcon	<u>Falco mexicanus</u>
Red-tailed Hawk	<u>Buteo jamaicensis</u>
Ferruginous Hawk	<u>Buteo regalis</u>
Marsh Hawk	<u>Circus cyaneus</u>
Red-winged Blackbird	<u>Agelaius phoeniceus</u>
Black-billed Magpie	<u>Pica pica</u>
Common Flicker	<u>Colaptes auratus</u>
Rock Dove	<u>Columba livia</u>
American Avocet	<u>Recurvirostra americana</u>
Horned Lark	<u>Eremophila alpestris</u>
Western Meadowlark	<u>Sturnella neplecta</u>
Robin	<u>Turdus migratorius</u>
House Sparrow	<u>Passer domesticus</u>
Chipping Sparrow	<u>Spizella passerina</u>
Chuckar Partridge	<u>Alectoris graeca</u>
Common Crow	<u>Corvus brachyrhynchos</u>
Ring-billed Gull	<u>Larus delawarensis</u>

\*All birds were identified using Birds of North America, Robbins, C.S., et al, Golden Press, New York, 1966.

APPENDIX B

1973 BIRD/AIRCRAFT STRIKE HAZARD SURVEY

AT

HILL AFB, UTAH

October 1973

**PRELIMINARY EVALUATION OF BIRD-AIRCRAFT  
STRIKE HAZARD AT HILL AFB, UTAH**

**BY**

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**AIR FORCE WEAPONS LABORATORY  
Air Force Systems Command  
Kirtland Air Force Base  
New Mexico**



**FOREWORD**

This research was performed under Program Element 63723F,  
Project 683M3E09 (Control of Birds in the Airport Environment).

Inclusive dates of the study were 28 through 31 August 1973.

This Technical Note has been reviewed and is approved.

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# ABSTRACT

1241 An evaluation of the bird-aircraft strike hazard involving gulls was made at Hill AFB, Utah, during the summer of 1973. Grasshoppers on the airfield served as the greatest attractant for gulls. Grasshopper control measures were initiated on 24 July 1973 by spraying Malathion insecticide, but had not been completed at the time of this survey. A sanitary landfill that had existed near the runway was permanently closed during the month of July 1973. This landfill had also been indicated as a gull attractant. Insect control and harassment of the pest bird species during the summer months is thought to be a feasible solution to the short-term problem.

The feasibility of using falcons for control of the gull-aircraft strike hazard was also considered. Falconry is not recommended at this time. If the present recommended control procedures fail, a closer look at control of the pest bird species by the use of birds of prey could be considered.

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## SECTION I. INTRODUCTION

### Purpose

This survey was undertaken to evaluate the gull-aircraft strike hazard at Hill AFB, Utah, and to determine if falconry could be employed as a control technique. The survey was initiated at the request of AFLC, Hill AFB with subsequent approval through command channels.

### Problem

Although Hill AFB has always had a bird problem, bird-aircraft strikes have increased during the past 6 years. This increase in the number of strikes can probably be related to increased training activity of the Utah Air National Guard, 1550th Helicopter Training Wing and the 508th (TAC) Fighter Group. Because the gulls are more active in this part of the state in June and July (Table 1), more strikes occur during this time. Other than entries indicating "gull" on strike reports, identification of birds causing strikes at the base has not been made. It is assumed that the two common species, the California Gull (Larus californicus) and the Franklin's Gull (Larus pipixcan) are involved.

Hill AFB is located about 6 miles east of Great Salt Lake. The islands, shores, estuaries, and refuges on the eastern shore of the lake constitute the center of the breeding population of the California Gull. Hundreds of thousands of gulls nest about the lake.

Two large nesting colonies are within 20 miles of the base. This species is the state bird of Utah and is rigidly protected.

Since this location is at the southern end of their breeding range, the Franklin's Gull nests in smaller numbers in the area. The population peaks immediately after the breeding season. They are very numerous in mid-June as they begin their southward movements (Reuben H. Dietz, pers. comm.).

The base has apparently been attractive to both these species of insectivorous gulls, for three reasons: the runway presents a high, open place for loafing; there is an abundance of food in the form of grasshoppers in the grassland surrounding the runway; and two garbage dumps within 2 miles of the runway offer other feeding opportunities.

Pigeons and starlings are pest species at the base and have been reported in strike records. Pigeons are controlled by poisoning, but this is only effective during the early winter when these birds come into the buildings on the base. Thus, the populations are allowed to build up during the summer. Starlings are reported to be numerous around the base in the fall and spring.

## SECTION II. ENVIRONMENTAL SETTING

Hill AFB is located about 30 miles north of Salt Lake City and 8 miles south of Ogden, Utah, on a high rolling alluvial plain. The land slopes gently toward the south, east and west of the base but drops abruptly toward the north into the Weber River Valley, the floor of which is about 200 feet below the level of the base.

The soils of the runway area (1,350 acres of grass) are essentially alluvial and, from comparisons with similar local range types, it was originally sagebrush. Grading has exposed banded sands, clays, and gravels. Presently the surface soils are mostly thin sandy clay loams. Gravel and sand surfaces supporting little plant growth are extensive, especially on the northeast side of the runway.

About half of the basic cover of the grassland surrounding the runway is cheatgrass (Bromus tectorum), which is indicative of very poor soil. In places where the soil is deeper, wheatgrasses (Western wheatgrass (Agropyron smithii), crested wheatgrass (Agropyron, spp.), thickspike wheatgrass (Agropyron dasystachyum), sand dropseed (Sporobolus cryptandrus), and Indian ricegrass (Oryzopsis hymenoides) have choked out the cheatgrass and have established good stands. There are also scattered patches of blue grama (Bouteloua gracilis), smooth brome (Bromus inernis), and alfalfa (Medicago sativa).

At the edges of the unlevel grassland, sunflowers, ragweed, Russian thistle, wild asters, wild mustards, snakeweed, rabbitbrush and three-awn grasses can be found.



An attempt to control sandblows by planting crested wheatgrass over the past 10 years has been moderately successful.

The grassland of the runway had been sprayed with Malathion 2 weeks before these observations and, thus, few live anthropods were seen. The dead carcasses of the grasshoppers were abundant over the area. In spite of the spraying, however, grasshoppers were common in certain areas, especially at the edges of the grassland and at extremities of the runway. Few other anthropods, including ants, dragonflies, and beetles could be found.

An active rodent control program is operative on the base, and there were only a few places where signs of the field mice and kangaroo rats could be found. These populations were small. Jackrabbits were quite common, and it was estimated that at least 20 inhabit the grassland of the flightline and its perimeter.

Native birds were scarce. A few Western Meadowlarks (Sturnella neglecta) and Horned Larks (Eremophila alpestris) were seen in the area. A family of five Burrowing owls (Speotyto cunicularia) were residing in the southeast corner of the grassland. California Gulls and Franklin Gulls are considered to be the primary flight hazards of the pest species. These gulls, however, had migrated out of the area and were not observed during this survey. Over 60 common pigeons (Columbia livia), in three flocks, fed in the grass near the runway. They could be seen, especially in the morning and late afternoon, flying over and about the runway. Starlings (Sturna vulgaris), which are reported to be a pest each fall and spring, were not observed during this survey.

### SECTION III. HAZARDOUS SPECIES

California Gulls, Franklin's Gulls, common pigeons, and Starlings are the most common birds about the base and are recorded as being involved in air-strikes. Almost no records are available on the abundance, movements or time of year and day that these birds are on the base. The information gathered was largely personal communication. Mr. Reuben H. Dietz, manager, Farmington Bay Wildlife Refuge, Utah, (about 10 miles southeast of the base), a recognized authority on gulls (Ref 3) supplied the information on the local gulls by personal communication.

The California Gull winters to the southwest of the state of Utah, mostly along the west coast. The gulls arrive on breeding grounds in late March, have eggs in the nest by 10 April, and the young are flying by mid-June. These gulls begin to move out of the state by mid-August and almost all are gone by the first of September. The demand for food reaches its peak in the months of June and July. If an abundance of insects, specifically grasshoppers, were present on the base during these months they could prove especially attractive to these gulls and would account for the increase in strikes at this time.

Franklin's Gulls follow almost the same breeding pattern. They migrate in large flocks through the Great Plains and winter in South America. They breed from Great Salt Lake north to the Canadian Prairies. Probably not more than 500 pairs nest around the Great Salt Lake. In the summer flocks of gulls wander through the area, but are generally gone by mid-August. The only identifiable remains

of gulls found near the runway were those of Franklin's Gulls. These "black-headed terns," as they are locally called, were implicated in the July air strikes. Base personnel reported observing regular morning flights of these birds across the south end of the runway in the direction of the presently operating Davis-Weber dump during July 1973. This dump is located less than 2 miles north of the southeast end of the runway.

Ring-billed Gulls (Larus delawarensis) visit the area from September through November. They are never very numerous, travel in small groups and are very shy. They are insectivorous and could be attracted to the base by an abundance of grasshoppers as well as to the garbage dump.

Pigeons constitute a hazard throughout the year. They reach a peak during late summer and are difficult to control due to abundant food. Almost every local barn has its small flock. About 60, in three flocks, visited the flightline each morning and afternoon during this study. They were feeding adjacent to the runway and flying back and forth across it.

Starlings were reported to be present in large flocks during the fall and winter. No data were available on their movements. It is not known whether they have been involved in air strikes.

Grasshoppers must be considered an indirect hazard on the base. Besides being the probable attractant for the gulls, Base Operations reports that during July 1973 there were days when the runway was slippery with them when driving along for runway checks.



#### SECTION IV. DISCUSSION

The outstanding feature of the bird-aircraft strike hazard at Hill AFB is that positive identification of struck birds has not been made. In addition no data have been collected on the ecology and behavior of any local pest species with respect to aircraft hazards. During the brief time of this survey, the details of biological influence on the problem could not be determined. Correlations between weather, plant growth, insect outbreaks, gull movements and air strikes could not be made. Further information on the species involved, their flight and feeding patterns, and diurnal and seasonal movements is needed (Ref 1).

The abundance of grasshoppers around the flightline and the presence of two garbage dumps in the near vicinity appear to be the main attractants for gulls. The base dump, which is located about 1/2 mile north of the southeast end of the runway was closed to all garbage waste in July 1973. Since then it has been used only for structural wastes. The Davis-Weber dump, which is located about 1 3/4 miles north of the southeast end of the runway, will continue to attract gulls. Nonconfirmed reports suggest that the gulls fly up and down the Weber River Valley to this dump. A control program on the base could be expected to cause the gulls to adopt this route.

Effective grasshopper control is badly needed. These insects were abundant in many places near the runway only 2 weeks after the spraying with Malathion was completed in August 1973. Present

spraying equipment consists of a tractor-mounted Buffalo Turbine that uses four No. 8 jets and covers a 50-foot wide swath on each pass. Under the limitations of manpower and available time near the runway, the job of covering the 1,350 acres around the runway took 2 weeks. The cost of this single operation was at least \$1,400.

It was essentially ineffective because the equipment was not able to cover the rough ground at the extremities of the runway, and by the time the spraying was completed the grasshopper population had already recovered, having been replenished by migrants from lateral unsprayed areas and by new hatches. By this time, too, the gulls had departed. To properly control these insects the grassland should be sprayed periodically from early May until mid-August.

Aerial spraying is the only method that can be really effective because it can be done in a short time and can cover all areas of the flightline and extend to adjacent areas. Effective grasshopper control using present methods will require an increase in manpower and equipment so that the spraying can be completed in at least 5 days.

Gulls are highly gregarious and communicate by a sophisticated array of vocal and visual signals. This enables a flock to recognize hostile environments without all individuals experiencing harm. Previous studies have demonstrated that in places where gulls are killed with some regularity they not only become scarce but leave completely (Ref 3). Since it is not possible to predict with cer-

tainty when pest species can be expected in the vicinity of the runway, the base must be prepared to chase them off at any time when they appear.

A mobile patrol unit with a shotgun and equipment to broadcast distress or alarm calls can be dispatched to disperse gulls from the runway. During the dispersal activity a few gulls should be shot; however, it is not necessary to kill gulls on every pass. Shot gulls should be spread out next to the runway for a few days as a reminder of danger to visiting gulls. In a short time the gulls should learn to avoid the runway. Live ammunition should be alternated with "shell crackers" to frighten birds that are well out of gunshot range. ("Shell crackers" are 12-gauge shotgun shells that fire a small bomb which explodes at about 175 yards). Radio coordination between the tower and the gull control vehicle is needed to ensure flight safety.

A log should be kept by Base Operations of gull sightings, especially during runway checks and by the control vehicle. The numbers and species of gulls, their activity, and response should be recorded. As data accumulate in this log it will become possible to anticipate and forestall bird-aircraft hazards.

Birds that are shot or struck by aircraft should be delivered to Pest Control for identification and recording of date, species, age, and stomach contents.

Every flight should be alerted to a bird hazard and be required to report each strike, whether damaging or not, irrespective of origin or destination.



The pigeon population should be controlled throughout the year. Trapping in a baited area away from the flightline, on a continuing basis, should keep pigeon populations at a minimum. This trapping is recommended because all pigeons that visit the flightline are not resident on the base and thus they are not subject to the control program designed to reduce their numbers inside the buildings.

## SECTION V. RECOMMENDATIONS

1. Appoint a project officer for the Bird-Aircraft Strike Hazard Program.

His duties would include:

- a. Procurement, equipping and supervision of the operation of the harassment vehicle and its personnel.
  - b. Coordination of data gathering from Flight Safety, Base Operations, and Pest Control.
  - c. Request from the U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife and the Utah State Wildlife Resources Division of Fish and Game for permits to shoot gulls if necessary.
2. Control grasshoppers by periodically using aerial spraying from May through mid-August. This can be accomplished by the 355 TAC Spray Flight, Lockbourne AFB, Ohio.
  3. Initiate a pigeon trapping program to operate on a continuing basis throughout the year.
  4. Advise aircraft on takeoffs and landings of bird concentrations on the airfield or in the vicinity and to avoid these areas. This procedure can be effected through coordination with Base Operations, the bird dispersal team, and the tower.
  5. An ecological survey should be made during the period when gulls are active in the area. This additional survey will be performed by the Air Force Weapons Laboratory in late April or May 1974. This survey will more accurately identify the relationships between gull behavior and ecology in the area and the bird-aircraft strike hazard.

6. Falconry as a means of gull control at Hill AFB, Utah is not recommended at this time for the following reasons:

- a. The gull problem period is only of two months duration.
- b. It takes experienced personnel and time to train birds of prey to attack gulls which are not their natural prey.
- c. If the falconer does not live locally he will require suitable area and facilities to maintain his birds of prey.
- d. The cost of a three month falconry program would be greater than the recommended insecticide spraying and harassment dispersal activities.
- e. Birds of prey are not usually flown during the summer months because they are molting at this time. Unless a program is established by the falconer to artificially stimulate early molting in his birds of prey they would not be in flying condition.



TABLE I

HILL AFB, UTAH

## BIRD STRIKES REPORTED BY MONTH AND YEAR

YEAR		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
65	Airdrome	1U				1G								2
	Other													0
66	Airdrome													0
	Other													0
67	Airdrome					1U								1
	Other													0
68	Airdrome													0
	Other													0
69	Airdrome						1G	1G	1G					3
	Other													0
70	Airdrome						1G							1
	Other													0
71	Airdrome					1U							1P	2
	Other													0
72	Airdrome				2U									2
	Other								1U					1
73*	Airdrome						3G	3G						6
	Other							1U						1

G - Gull  
P - Pigeon  
U - Unknown

Information on bird strikes from 1965 thru  
1972 was obtained from Norton AFB, Safety  
Bird Strike Data Reports.

\* Information on gull strikes 1973 was obtained from Hill AFB, Flight Safety  
Office Records.

### REFERENCES

1. AFWL TR-71-94, Ecological Aspects of Bird-Aircraft Strike Hazards, Sobieralski, R.J.
2. U.S. Geological Survey - (Period 1931-1960)
3. Personal Communications: Mr. Reuben H. Dietz, Manager, Farmington Bay Wildlife Refuge, Farmington Bay, Utah.

## APPENDIX C

For bases requiring active bird scaring techniques the following equipment is authorized for bird identification and dispersal:

<u>Nomenclature</u>	<u>NSN</u>	<u>TA</u>
Binoculars, prism type	1240-00-5300959YB	479/483
Shotgun, single barrel	1005NC121528L	479/483
Pistol, pyrotechnic	1095-00-726-5637	479/483
Simulator airburst	1370-00-028-6007	-
Shellcrackers, 12 ga.	1305ND042951G	-
Cassette Type Player	5835-01-053-3152	*
Speaker	5965-01-053-6210	*
Amplifier, mobile	5830-01-054-4954	*

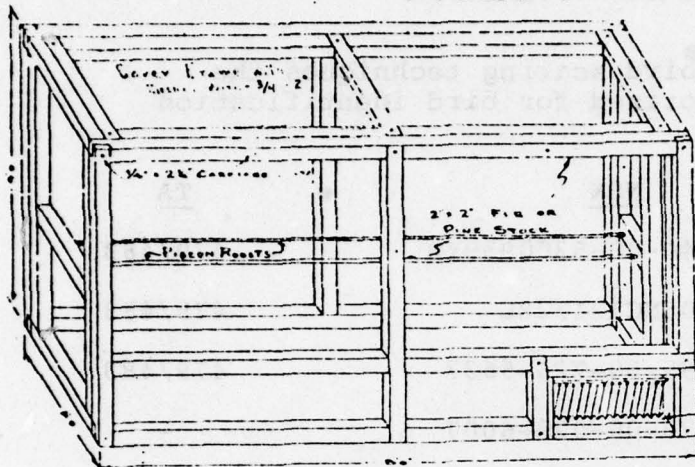
\* Stocklist action has been completed and upon receipt of NC/NSN items will be added to TA 483.

This memorandum may be referenced to justify procurement of items from TA 483, which is a Civil Engineering TA. Any organization responsible for bird control on the base may procure this equipment.

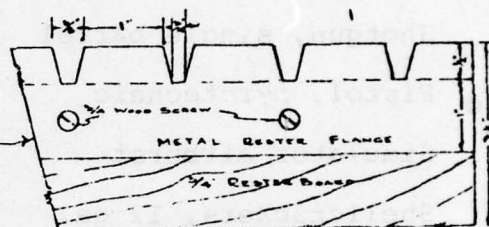


## APPENDIX D

# PIGEON TRAP PLAN



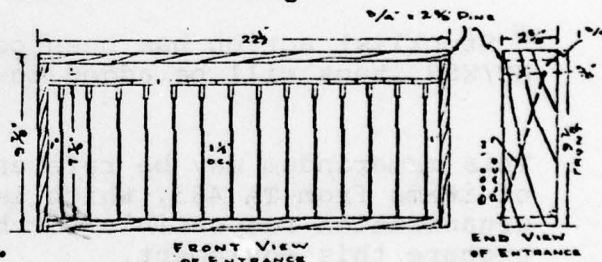
Pigeons can be caught in screened enclosures of various sizes and shapes. For large-scale trapping, it is well to use a trap of dimensions similar to those shown in this leaflet.



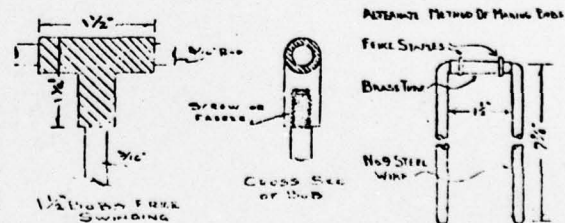
This size trap is capable of large daily catches and enables a person to enter and remove the birds through a small door constructed in the end of the trap. Although large traps are preferred, good catches have been made with poultry crates and other small enclosures.

The construction of a trap with 1 x 2 -inch material is desirable so as to reduce the weight, which is a factor if the trap is to be moved. The use of bolts and the construction of the trap in five sections will facilitate dismantling.

The door or entrance through which pigeons are lured is the principal feature of a trap. Individual, free-swinging "bobs," as illustrated, are most practical and successful. The bobs can be made of heavy aluminum wire or lightweight metal rods. It is important that they swing upward and inward easily and drop back smoothly into slots at the base of the door. For sources of readymade trap doors, write for leaflet entitled, "Manufacturers of Bird Control Materials."



A colony of pigeons will usually remain in one general area, which tends to simplify their removal. Set a trap in an inconspicuous spot, where its not apt to be molested, near the place where pigeons feed or roost. Leave a few birds in the trap as decoys, preferably the same individuals, so that they will become fairly tame and thus lure others. Birds with distinctive colors can be easily identified and seem to be better lures than the drab blue-grays.



It is important to bait the trap with the kind of food the birds are eating. Where they are used to miscellaneous feed, a mixture of one part wheat to five parts of cracked corn makes a good bait. Scatter a small amount outside the trap door to attract the birds. Keep a generous quantity of the bait on the floor inside and near the trap door at all times. Water should be provided except during periods when snow will furnish the necessary moisture. Visit the trap every day or two to remove the pigeons and to rebait.

# DISTRIBUTION LIST

HQ USAF/X00 WASH DC 20330	1	AFRCE/WR-ROV 630 Sansome St San Francisco CA 94111	1
HQ USAF/LEEV WASH DC 20330	8	AFRCE/ER-ROV Main Tower Bldg 1200 Main St Dallas TX 75202	1
HQ USAF/ISC WASH DC 20330	1	AFRCE/CR-ROV 526 Title Bldg Atlanta GA 30303	1
AFISC/IGD Norton AFB CA 92409	1	OEHL/CC Brooks AFB TX 78235	1
AFISC/SEFF Norton AFB CA 92409	1	1 CSG/OTM Attn: MSgt Godsey Langley AFB VA 23665	1
HQ TAC/DE Langley AFB VA 23665	1	SAMSO/DEV Attn: Maj Wooten PO Box 92960 Worldway Postal System Los Angeles CA 90090	1
HQ TAC/DOV Langley AFB VA 23665	1	HQ AFLC/IGFF Wright-Patterson AFB OH 45433	1
HQ MTC/IGFF Langley AFB VA 23665	1	HQ AFLC/DEV Wright-Patterson AFB OH 45433	1
HQ TAC/DEV Langley AFB VA 23665	1	AFESC/OI Tyndall AFB FL 32403	1
HQ AFLC/DE Wright-Patterson AFB OH 45433	1	3700 Tech Tng Wing TTGIC/48 (Entomology) Sheppard AFB TX 76311	1
HQ AFLC/DOV Wright-Patterson AFB OH 45433	1	Federal Aviation Administration MAS/300 Attn: Capt Harrison 800 Independence Ave WASH DC 20591	2
DDC/TCA Cameron Station Alexandria VA 22314	2		
HQ MAC/DEMM Scott AFB IL 62225	2		
AFPCB/MEIS Forest Glen Section WRAMC WASH DC 20012	1		

2849 ABG/OTM 1  
Hill AFB UT 84406

2849 ABG/CC 1  
Hill AFB UT 84406

2849 ABG/OT 1  
Hill AFB UT 84406

2849 ABG/DE 1  
Hill AFB UT 84406

2849 ABG/DEEXX 1  
Attn: Murray Sant  
Hill AFB UT 84406

2849 AFB Det 2/CC 1  
Hill AFB UT 84406

388 TFW/CC 1  
Hill AFB UT 84406

388 TFW/DO 1  
Hill AFB UT 84406

388 TFW/SE 1  
Hill AFB UT 84406